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THE IRON-ORE PROBLEM OF LORRAINE

SUMMARY

Importance of iron-ore reserves of Lorraine, 531.—Comparison with reserves of other countries, 534. — Quality and location of French reserves, 535. — Dependence of German steel industry upon Lorraine, 536.—Also of French steel industry, 538.—Probable French policy of control, 540. — Coal production of France and Germany, 544. — Importance of the Saar district, 547. — German pre-war view of importance of controlling iron in the interest of militancy, 552.

THE victory of the Allies in the late world war puts an end — for the present at least — to the pan-German ironmaster's dream of an industrial hegemony based upon national self-sufficiency with regard to the control of the sources of raw materials. This dream was apparently a cause of the war just closed. In the acquisition of Alsace-Lorraine in 1870–71 Germany recognized the possibilities for her iron and steel manufactures involved in the possession of extensive iron-ore fields. The rapid growth of the German iron and steel industry during the two decades immediately preceding the war was based in part upon the control of the iron ores of Lorraine. Had Germany won the war there is little doubt that this control would have been extended over the rich ore fields of northeastern France. The defeat of Germany, however, will not only frustrate her ambition to increase her possessions of valuable ore properties but deprive her of what she had gained in the Franco-German War of 1870–71.

The restitution of Alsace-Lorraine will return to France the possession of over two billion tons of iron ore, and with the supplies in the adjoining territory of French Lorraine, will give to that country the finest iron-ore basin in Europe, and one of the finest in the world. The magnitude of the iron-ore reserves of Lorraine — both German and French — may be indicated by a brief description of the region in which these deposits are located and a comparison with the total reserves of Europe and with the leading iron-ore fields in other parts of the world.

The Lorraine area forms a part of a great basin of ores (minette) embracing a part of northern France, southwestern Germany, Luxemburg and southern Belgium. The mining region of French Lorraine comprises about 150,000 acres with a possible addition of 30,000 acres.[1] This field is divided into certain folds or basins, of which the basin of Briey is the most important and contains about two-thirds of the estimated supplies of French Lorraine.[2] German Lorraine is somewhat more compact covering an area of about 108,000 acres.[3] This area has supplied the iron and steel industry of western Germany with the greater part of its ore.

In 1910 the actual or proved reserves of iron ore with their equivalent metallic iron content were estimated for the Lorraine region as shown by the table on page 533.[4]

Out of this enormous total of actual or proved ore reserves France, with the possession of what has been German Lorraine, will have in this field deposits amounting to 5,330,000,000 tons, capable of yielding

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[1] The Iron and Coal Trades Review (London), December 6, 1918, p. 633.

[2] Bulletin of the American Institute of Mining Engineers, September, 1918, pp. 1492–96.

[3] The Mineral Industry for 1917, p. 357. The Mineral Industry is published yearly by the McGraw-Hill Book Company of New York.

[4] Iron Ore Resources of the World, vol. i, pp. xxvi, xxvii, xliii and xlv. The best survey which has yet been made of the iron-ore resources of the world was that undertaken at the initiative of the Executive Committee of the Eleventh International Geological Congress held in 1910 at Stockholm, Sweden. The results of the survey were published in two large volumes with the above title.

(000's omitted)

Territories	Actual ore supplies[1]	Equivalent metallic iron content	Potential ore supplies[1]
	(metric tons)	(metric tons)	
French Lorraine	3,000,000	1,000,000	
German Lorraine	2,330,000	755,000	Very considerable
Luxemburg	270,000	90,000	
Belgium	62,000	25,000	
Total	5,662,000	1,870,000	

1,755,000,000 tons of iron. The iron-ore reserves of German Lorraine constituted nearly two-thirds of the proved deposits of the German Empire, and those of French Lorraine, over 90 per cent of the estimated total of France. The results of the redistribution of these supplies upon the reserves of the two countries named may be indicated as follows:[2]

(000's omitted)

Time	France		Germany	
	Actual ore supplies	Equivalent metallic iron content	Actual ore supplies	Equivalent metallic iron content
	(metric tons)	(metric tons)	(metric tons)	(metric tons)
Before the war	3,300,000	1,140,000	3,607,700	1,270,000
After the war	5,630,000	1,895,000	1,277,000	515,000

The proved iron-ore reserves of all Europe were computed in 1910 at 12,031,900,000 metric tons with an equivalent metallic iron content of 4,732,800,000 metric tons. The supplies of France, therefore, as a consequence of the war, now constitute over 45 per cent of the estimated actual iron-ore reserves of Europe, and over 40 per cent of their iron content.

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[1] The term actual is used to signify proved and commercially valuable ore. Potential is the word used to designate ore supplies which under present conditions cannot be profitably exploited, because of low iron content, unfavorable location with respect to means of transportation, or deleterious ingredients. The dividing line is by no means clearly drawn.

[2] Iron Ore Reserves of the World, vol. i, pp. lxxiii–lxxv.

All but 300,000,000 tons (a little over 5 per cent of the total) of the French deposits are in a tolerably compact area, and not very far from coal.[1] In these respects the ore resources of France differ from those of other important ore-producing countries of Europe. The remaining reserves of Germany while still great are diffused over a considerable territory. The large supplies of Great Britain[2] are also rather scattered, and those of Russia are distributed over a very wide area. The well-known deposits of Spain and the magnificent reserves of northern Sweden are located in countries or regions with very limited supplies of coal.

The Lorraine region is one of the six leading iron-ore districts of the world. These districts with their reserves, as estimated in 1910, are tabulated below:[3]

LEADING IRON-ORE DISTRICTS OF THE WORLD
(000's omitted)

Territories	Actual ore supplies	Equivalent metallic iron content	Potential ore supplies	Equivalent iron content
	(metric tons)	(metric tons)	(metric tons)	(metric tons)
Lake Superior, U. S. . .	3,500,000	2,000,000	72,000,000	36,000,000
Lorraine:				
France, Germany, Luxemburg, Belgium	5,662,000	1,870,000	Very considerable	
Northern Sweden.	1,035,000	670,000	178,000	105,000
Oriente, Cuba	1,903,000	856,800	1,007,000	454,000
Bell I., Newfoundland	3,635,000	1,961,000	. . .[4]	
Minas Geraes, Brazil. .	. . . .	. . . .	5,710,000	3,055,000

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[1] This coal, however, is mainly within German territory.

[2] Iron Ore Reserves of the World, vol. i, pp. lxxiii–lxxv. The actual reserves of Great Britain were computed at 1,300,000,000 tons with an iron content of 455,000,000 tons. The potential reserves were estimated at a very much higher figure — over 37 billion tons, exceeding that of any other country in Europe.

[3] Iron Ore Reserves of the World, vol. i, pp. xxvi–lxxix. See also Bulletin of American Institute of Mining Engineers, September, 1918, pp. 1472–1479.

[4] The potential supplies of western Newfoundland are given as "enormous." These ores, however, contain much titanium which under present metallurgical processes materially reduces the value of the ore.

Since 1910 some of these estimates in the more recently surveyed fields have changed. The proved reserves of the Province of Oriente, Cuba, are now estimated at 3,000,000,000 tons, and those of Minas Geraes, Brazil, at approximately 3,500,000,000 tons.[1] The resources of northern Sweden are also rated somewhat more highly than the above figures indicate, and the potential ore supplies of the Lake Superior district are materially reduced under later estimates.

The importance of the Lorraine field is not alone indicated by the richness of its ore deposits. None of the other great reserves above tabulated, including even the Lake Superior region of this country, are so favorably situated with respect to the sources of coal and limestone — barring the question of political boundary lines — and so near some of the leading markets for iron and steel goods. The deposits of northern Sweden, Cuba and Brazil are located in regions with a very inadequate coal supply. Even in the case of the Lake Superior deposits which are near enough to the Great Lakes to afford the advantages of cheap water transportation, the cost of ore at blast furnaces at lower lake ports and in the Pittsburgh district is practically doubled by the expense of shipment.[2] It is true that in iron content per unit of output the ores of Lorraine are inferior to those of Sweden, Brazil, Newfoundland, and Lake Superior.[3]

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[1] E. C. Harder of U. S. Geological Survey, in Bulletin of American Institute of Mining Engineers, September, 1918, p. 1472. Also page 1479.

[2] The Commissioner of Corporations in his Report on the Steel Industry estimated the book cost of ore at lower Lake ports, including general expenses, taxes and depreciation at $2.64 per gross ton. Of this total the rail freight amounted to $0.67, and the Lake freight, including marine insurance, to $0.74. See Report, Part III, p. 34. Out of a total cost of $2.64, $1.41 constituted transportation charges. Before the outbreak of war in Europe the price of standard non-Bessemer Mesabi ore (51.50 per cent iron content) at lower Lake ports was quoted at an average price for the years 1911–14 at $3.15 per gross ton. About half of that price represented transportation charges.

[3] The iron content of Lorraine ores averages about 35 per cent. The ores of Sweden and Brazil range from 65 to 70 per cent and those of Newfoundland and Lake Superior from 50 to 60 per cent.

It may also be pointed out that owing to the relatively large proportion of phosphorous in these ores they are not suited for the manufacture of certain grades of steel.[1] These disadvantages, however, are more than offset for ordinary iron and steel manufacture by their geographical location.

The importance of the Lorraine deposits is further emphasized by the fact that in the years immediately preceding the outbreak of hostilities they were supplying the bulk of the iron ore of the two leading ore-producing countries of Europe,[2] and were furnishing the raw material upon which their iron and steel industries were built. In 1913 the iron-ore production of Germany (excluding Luxemburg) amounted to 26,771,598 tons.[3] This production was greater than that of any other country in the world except the United States. Of the German output 21,135,554 tons were mined in Lorraine.[4] If the production of Luxemburg amounting to 7,332,000 tons were added to that of German Lorraine we should have an iron-ore output for the Luxemburg-Lorraine district of nearly 28,500,000 tons, and for the territory embraced within the German Customs Union of over 34,000,000 tons.[5] France produced in 1913, 21,572,835 tons of iron ore, of which over 90 per cent was produced in the mining districts of Briey, Nancy, and Longwy — in what is called French Lorraine. Altogether, therefore, the Lorraine field was supplying Europe just before the war with an annual ore tonnage of between 45 and 50 millions.

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[1] For the making of Bessemer steel, i.e., acid Bessemer, the Lorraine ores are unsuited. For some kinds of manufacture Bessemer steel is superior to basic steel and for some kinds of ordnance material low-phosphorus steel is necessary. Bessemer ore must not contain more than one part phosphorus to 1,000 parts metallic iron. In the case of low-phosphorus ore the proportion of phosphorus allowable is less than half that of Bessemer. The best ore field now known for Bessemer and low-phosphorus ores is that of Brazil.

[2] The production of iron ore in the United Kingdom which ranked third among the countries of Europe was 15,997,328 tons. While the United Kingdom produced less ore than France she surpassed that country in the manufacture of pig iron and steel.

[3] Mineral Resources of the United States, 1915, p. 318. Work published by the U. S. Geological Survey.

[4] The Mineral Industry for 1917, p. 357.

[5] The Iron Trade Review, January 2, 1919, p. 30, and Mineral Resources, 1915, p. 318. The Iron and Coal Trades Review (London) gives the production of Luxemburg for 1913 as 7,332,000 tons. See number of November 5, 1918, p. 517.

This immense production formed the basis of the flourishing iron and steel industry of Germany and was the foundation of the iron and steel manufactures which had grown up in France. Without the exploitation of the Lorraine deposits the astonishing development of the iron and steel industry of Germany would be unthinkable, and the acquisition of a large part of these deposits by Germany in 1871 was doubtless a factor in hastening this development. The importance of the Lorraine deposits in relation to this industrial growth is not indicated alone by the iron and steel manufactures of Alsace-Lorraine, but by the fact that the entire industry in the Rhenish-Westphalia and the Saar districts, depended upon Lorraine.[1] These districts are within easy reach of the region discussed, and with Lorraine-Luxemburg produced the bulk of the iron and steel of Germany. The pig iron production of Germany in 1913 amounted to 19,291,920 tons, and was distributed among the different provinces in the following proportions:[2]

PROPORTION OF THE TOTAL PIG-IRON PRODUCTION OF GERMANY (INCLUDING LUXEMBURG) BY DIFFERENT PROVINCES, 1913

District	Percentage
Rheinland-Westphalia	42.5
Siegerland, Lahn, and Hesse-Nassau	5.1
Silesia	5.2
Central and East Germany	5.2
Bavaria, Württemburg, and Thuringia	1.6
Saar	7.1
Lorraine and Luxemburg	33.3

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[1] Iron Trade Review, January 2, 1919, p. 30.

[2] The Iron and Coal Trades Review (London), January 16, 1914, p. 97. Figures are taken from the Statistical Bureau of the Verein Deutscher Eisen- und Stahl-Industrieller.

It will be observed that the Rhenish-Westphalia and Saar districts and Lorraine and Luxemburg produced in 1913 over 80 per cent of the pig-iron output of the territory embraced within the German Customs Union. Historically and geographically the iron and steel industry of these districts is intimately bound up with the mining development of Lorraine.

It is not to be overlooked, however, that Germany in recent years has been a heavy importer of iron ore. While the bulk of this raw material in the pre-war period came from domestic sources the proportion supplied by foreign countries was increasing.[1] In 1913 the importation of iron ore amounted to over 14,000,000 tons, of which 4,558,000 tons came from Sweden, 3,811,000 tons from France and 3,632,000 from Spain.[2] The significant importation from France, however, represents a supply from the same source as the domestic output, but on the other side of a political boundary line.

The French iron and steel industry has been even more dependent upon Lorraine ore than the German. The manufacture of iron and steel, however, notwithstanding the great ore production and reserves of the country, has undergone no such striking development as in Germany. The iron-ore resources of France were nearly as great as those of her neighbor, and the deposits of French Lorraine has been estimated at a higher figure than those of German Lorraine. Nevertheless, while the output of pig iron in Germany in 1913 amounted to 19,291,920 tons, that of France was only 5,311,316 tons.[3] During the same year Germany produced 18,958,819 tons of steel, and France only 4,419,241 tons.[1] In other words, France with an iron-ore production equivalent to about two-thirds that of Germany (including Luxemburg) and reserves nearly as great had a pig-iron output considerably less than one-third and a steel production of less than one-fourth.

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[1] Commercial Relations of the United States, 1912, published by the Bureau of Foreign and Domestic Commerce, pp. 36–39. In 1911 the importation of iron ore into Germany amounted to 10,820,485 metric tons, and in 1912, to 12,120,090 metric tons.

[2] Iron Trade Review, January 2, 1919, p. 30.

[3] Mineral Industry for 1917, p. 346. The figures are given in metric tons (2,204.6 pounds).

French iron and steel manufacture absorbed only a part of the country's output of ore. The situation may be indicated by comparing the production with the apparent consumption in the two calendar years immediately preceding the outbreak of war.

CONSUMPTION OF IRON ORE IN FRANCE, 1912 AND 1913 [2]

	1912 (tons)	1913 (tons)
Production	18,858,668	21,572,835
Imports	1,454,190	1,417,063
Exports	8,323,712	9,745,863
Apparent consumption	11,989,146	13,244,035

In 1912 the net exports of iron ore of France amounted to 6,869,522 tons with an apparent consumption of 11,989,146 tons, or less than two-thirds of the year's production. In 1913 the net exports were 8,328,800 tons, or considerably more than one-third of the annual production, leaving for home consumption 13,244,035 tons. In other words, the net exports of iron ore from France in the years just prior to the war were about 35 per cent of her annual production. In contrast with this, Germany's imports of iron ore for the same two years were 12,120,090 and 14,017,000 tons respectively, and her annual exports only a little over 2,000,000 tons.[1] Germany with an iron-ore production considerably larger than that of France, and including within her tariff boundary line the added output of Luxemburg, had in 1912 and 1913 a net importation of ore equivalent to about one-third of her domestic production.[2]

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[1] Mineral Industry for 1917, p. 347. The tonnages for steel are given in terms of ingots and castings. A slightly higher figure is given in the Iron and Coal Trades Review, April 10, 1914, p. 541, for the production of steel in France.

[2] Mineral Resources of the U. S., 1915, p. 318, and Mineral Industries during 1913, p. 418.

The war just closed has, by the restoration of Alsace-Lorraine, added to the already great reserves of France the deposits from which the German iron and steel industry has drawn the greater part of its ore. Will this addition result in the transfer of this great industry to France ? Does the loss of Lorraine mean the complete or partial demoralization of German steel manufacture ?

It is evident that many French writers and statesmen look forward to a development of the iron and steel industry in France corresponding to its wonderful growth in Germany in the pre-war period, and probably greatly surpassing it. The support which the German industry gave to the military operations of the Central Powers has given birth to a desire on the part of many to see this industry in Germany crippled, or at least its Continental leadership taken away.

It is well known that in the manufacture of iron and steel a large amount of coal is consumed. It is also well known that while France possesses some important coal deposits her coal resources are not very extensive and her consumption of coal far exceeds her production. The Lorraine district which has been recently added to her territory brings with it no material addition of coal. The redistribution of territory between France and Germany virtually amounts to putting iron ore on one side of a political boundary line and coal on the other.

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[1] Bureau of Foreign and Domestic Commerce: Commercial Relations of the United States, 1912, pp. 36, 39, and Iron Trade Review, January 2, 1919, p. 30.

[2] The production of iron ore in Germany (including Luxemburg) in 1912 was 33,180,258 metric tons and in 1913, 34,103,598 metric tons (26,771,598 for Germany proper and 7,332,000 for Luxemburg). Mineral Resources, 1915, p. 318, and Iron and Coal Trades Review (London), November 5, 1918, p. 517.

This division of material resources would not seriously affect the economic situation if iron ore and coal were left free, or relatively so, to pass between the two countries under consideration. But this freedom comes into conflict with a strong national purpose to keep French ore at home and make it contribute to the upbuilding of a great iron and steel industry in France. Furthermore the Germany industry being looked upon as something of a military, as well as a commercial, menace Lorraine ore must no longer constitute its basis as in the past. The old interchange of French ore for German coke is pronounced out of question.[1]

How far a political or patriotic purpose can modify an industrial condition depends upon a number of factors. An unwise fiscal policy can injure and sometimes destroy an industry. A tariff barrier may interrupt or change the normal current of trade. But the enactment of a legislative body or the decree of an international council cannot change natural resources or alter geographical facts. Political boundary lines, it is true, may be made to conform to such conditions, but the successful consummation of any political aim depends upon its adaptation to the natural and economic possibilities of the situation.

Are those who look forward to a rapid and extensive development of a French iron and steel industry based upon Lorraine ore justified in their anticipations ? Or do such anticipations come into conflict with an economic condition ?

It is unsafe to make predictions, as there are many circumstances in the present industrial situation, the influence of which it is impossible to gauge. However, certain facts in this situation may be pointed out, and a rough estimate made of their probable influence. Some of these facts are well-known and appreciated, and others are popularly ignored.

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[1] The situation is discussed in a series of articles published in L'Information by M. C. Marquet (Ingenieur Civil des Mines).

In the manufacture of some iron commodities and most articles of rolled steel, the consumption of coal (including coke) is greater than that of iron ore. The oft-repeated statement that it takes more coke than ore to produce a given amount of pig iron is not true of the product of the blast furnace of today. The tendency for the ore to move toward the coal rather than for the coal to travel toward the ore cannot be explained by the relative quantities of ore and coal necessary to produce a ton of pig iron. This can be seen by comparing the proportionate amounts of material entering and leaving a modern blast furnace when a ton of pig iron is manufactured out of ordinary ore containing about 50 per cent of iron:

ENTERING THE FURNACE	(tons)	LEAVING THE FURNACE	(tons)
Iron ore	2	Pig iron	1
Coke	1	Slag	0.5
Limestone	0.5	Gases	6
Air	4		
	7.5		7.5

It will be observed that in the case of 50 per cent iron ore the approximate proportion of coke to ore used in the smelting process is one to two. In the case of low-grade ores the coke consumption is greater, but less than the quantity of ore used. In the manufacture of coke the amount of coal consumed varies considerably, but with superior grades four tons are required to make three tons of coke.

The greater part of the pig-iron production of the world is converted into steel.[1] In 1916 the pig-iron production of the United States amounted to 39,434,797 gross tons, and the steel output (in terms of steel ingots and castings), to 42,773,680 gross tons.[2] In 1913, as has already been noted, the pig-iron production and steel output of Germany were 19,291,920 and 18,958,819 metric tons, respectively, and the corresponding figures for France were 5,311,316 and 4,419,241 metric tons.[3] It is especially in the advanced stages of steel manufacture that the aggregate fuel costs mount high enough to make it an object for the producer to be nearer his coal supply than his sources of iron ore. In the production of certain forms of rolled steel the amount of fuel consumed is as much as four tons of coal to one ton of steel.[4]

In addition to this influence operating on the producing side of steel manufacture is that of the desirability of being near the leading markets for steel goods. The bulk of the steel consumed under modern industrial conditions takes the forms of railway material including rails, structural shapes, heavy machinery, plates, and the like, and the principal markets for such products are in great manufacturing centers located near coal-producing regions.

As long as coal remains the most important source of power in the operation of modern machinery and its consumption per unit of steel output continues to be practically what it is at present, the iron and steel industry will tend to seek the coal area. Lake Superior ore will move toward Pennsylvania coal rather than Pennsylvania coal toward Lake Superior ore.[1] Swedish ore will travel toward German and English coal rather than the coal in the reverse direction.

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[1] The conversion usually takes place in one heat, i.e., the iron is not allowed to cool before bringing it to the Bessemer converter or the open-hearth furnace.

[2] Annual Statistical Report of the American Iron and Steel Institute, 1916, pp. 3 and 23. The apparent statistical discrepancy in the outputs of pig iron and steel is explained by the large use of scrap material in steel manufacture.

[3] Mineral Industry for 1917, pp. 346 and 347.

[4] The writer is indebted for this information as well as other technical details embodied in this article to Bradley Stoughton.

The situation with respect to coal, brought about by the restitution of Alsace-Lorraine to France, may be considered with reference to the coal production and trade of that country in comparison with that of Germany, the comparative resources of the two countries in the bituminous product and the efforts and proposals of French writers and statesmen to meet the situation.

The production of coal in France and Germany, in the two calendar years immediately preceding the war, given in short tons, were as follows:[2]

	1912	1913
France..................	45,534,448	45,108,544
Germany...............	281,979,467	305,714,664

The output of Germany in each of the years considered was between six and seven times that of France. In both France and Germany production was largely concentrated in a few districts. About 70 per cent of the output of France came from the Nord and Pas-de-Calais districts — the latter producing about half that of the country.[3] The mining of coal in Germany, while operated on a fairly large scale in various parts of the country, is most extensively carried on in the Ruhr district, the output of which was about one-half that of the empire in 1912 and 1913.[4]

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[1] There have been some apparent movements in the United States which seem to contradict this principle, e.g., the organization of the Minnesota Steel Co., a subsidiary of the United States Steel Corporation, at Duluth, Minn. Coal is shipped from lower Lake ports to Minnesota. It should be remembered, however, that coal is carried on the Great Lakes at exceptionally low rates and as a return cargo for ore-bearing steamers. Furthermore, the company produces heavy steel for markets in the Northwest — particularly railroad material, structural shapes, etc.

[2] Mineral Industry for 1917, p. 127.

[3] Ibid., 1913, p. 118.

[4] Ibid., 1913, p. 119.

In both countries the production of bituminous coal exceeded that of anthracite[1] and lignite. In Germany much of the bituminous product makes good coke.[2] In 1913 the production of coke in Prussia amounted to 34,000,000 tons.[3] In France, on the other hand, good coking coal is scarce, and in 1913 the French output of coke was only about one-tenth that of the Prussian production.

The coal and coke consumption of France far exceeds her production. In 1913 the coal imports amounted to 18,693,123 tons, this importation being an increase of more than 2,700,000 tons over that of the preceding year.[4] During the same year the French consumption of coke for metallurgical purposes was about 6,500,000 tons,[5] but of that consumption 3,070,036 tons were imported. Considerably over half the imported coal came from Great Britain, and about four-fifths of the coke from Germany.[6]

In contrast with this, German coal and coke production exceeds consumption. For many years Germany has been one of the world's great exporters of coal. In 1913 the net exports of coal from that empire aggregated over 24,000,000 tons, and those of coke about 6,000,000 tons.[7]

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[1] A small amount of anthracite is produced in both France and Germany, but it is inferior to the anthracite of eastern Pennsylvania and South Wales.

[2] Coke is a product of bituminous coal, but not all bituminous coal is coking coal. Experiment is necessary to determine whether a given coal has the qualities necessary for making good coke. These qualities cannot be stated in chemical terms alone. See Tiemann, Iron and Steel.

[3] The Iron and Coal Trades Review (London), December 13, 1918, p. 673.

[4] Mineral Industries during 1913, p. 118.

[5] The Iron and Coal Trades Review (London), December 6, 1918, p. 633.

[6] Mineral Industries during 1913, pp. 118–120.

[7] Ibid. The exports of coal and anthracite were 34,573,514 tons, and the imports were 10,540,018 tons. The coke exports amounted to 6,411,418 tons. There was a small importation of coke from Belgium.

The coal reserves of France, as estimated in 1913,[1] do not promise very much in the way of any large permanent increase of output. The reserves of bituminous coal, which is the fuel of iron and steel manufacture as well as of other manufactures, were estimated for France, Germany, and Europe as follows: [2]

(000's omitted)

Countries	Actual reserves	Probable reserves	Total
	(tons)	(tons)	(tons)
France	3,622,000	9,058,000	12,680,000
Germany	94,865,000	315,110,000	409,975,000
Europe	236,716,000	456,446,000	693,162,000

The largest reserves of bituminous coal in Europe are in the Belgian-German basins. The British fields are more easily exploited and a larger percentage of their reserves extracted.[3] But the basins named, particularly Germany, have much larger amounts. Of the total estimated European reserves of bituminous coal (actual and probable) nearly 60 per cent is in Germany and less than 2 per cent in France.

The coal reserves of France and Germany remain practically unaltered by the transfer of Alsace-Lorraine to France. The distribution of the bituminous coal reserves within Germany shows that this transfer affected no appreciable change in the fuel situation.

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[1] A survey of the coal reserves of the world similar to that of the iron-ore resources was undertaken by the International Geological Congress held in 1913 in Canada. The results were published in three large volumes under the caption "The Coal Resources of the World."

[2] The Coal Resources of the World, vol. i, pp. xxxv and xxxvii. These reserves are divided in the case of Europe into "actual" and "probable." Actual reserves are those where the actual thickness of the seams can be arrived at, and probable reserves are those where an approximate estimate only can be made.

[3] The Coal Resources of the World, vol. i, p. xxvi.

BITUMINOUS COAL RESERVES OF GERMANY BY DISTRICTS [1]
(000's omitted)

Districts	Actual reserves	Probable reserves	Total
All Germany	94,865,000	315,110,000	409,975,000
Saar district	16,548,000	....	16,548,000
Westphalia	56,344,000	157,222,000	213,566,000
Lower Silesia	718,000	2,226,000	2,944,000
Upper Silesia	10,325,000	155,662,000	165,987,000
Saxony	225,000	....	225,000
Left of Rhine	10,458,000	....	10,458,000
Other districts	247,000	....	247,000

Of the districts tabulated — and they include all the bituminous coal reserves of the former German Empire — only that designated left of Rhine covered any part of the Lorraine region, and that only in a limited degree. The Saar district is in very close proximity to the Lorraine field. The Westphalian district, which is by far the largest and most highly developed of the coal regions of the country, has been the principal seat of the iron and steel industry of Germany. This industry has depended in the main upon ore from German Lorraine and to a limited extent upon supplies from the adjoining field in France.

The relatively restricted supply of coal has been the cause of the high prices charged for that fuel in France. Figures have been published concerning average prices of coal in France, and comparisons made with the corresponding prices in other countries. Recently these figures have been used for determining the effect of fuel costs upon the prices of iron and steel goods,[2] and the results are significant. In 1913 according to these estimates the price of French coal at the pit was $3.32 per ton and that of imported coal $4.74. Worked out on the basis of the amounts produced in the country and imported the average price was $3.55 per ton. This average exceeded that of the United States by $2.28, that of England by $1.32, and that of Germany by $0.96. In the case of home-made coke the average price in France was $4.37 per ton, and that of imported coke $5.63, with an average price for both of $5.11. This estimate exceeded the averages of the United States, England, and Germany, by $2.69, $1.76, and $0.82, respectively.

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[1] The Coal Resources of the World, vol. i, p. xxxvi.

[2] An account of these computations is given in the Iron and Coal Trades Review (London), January 10, 1919, p. 47. In stating the figures the writer has converted them into American currency.

These figures have been used to show that the normally high prices of pig iron and finished steel material in France are, to a great extent, the result of the cost of coke and coal. The production of a ton of pig iron requires not less than a ton of coke, and generally in Europe, appreciably more. The conversion of this pig iron into finished product necessitates the use of at least a ton of coal, and in some cases two or more tons. Higher fuel prices are thus an important factor in increasing iron and steel costs in France over those of the United States, England, and Germany. A computation based upon similar but somewhat later figures, made by M. de Nanteuil, State Mining Engineer, shows that the cost of producing pig iron is increased in France because of the higher cost of coke by $1.35 per ton over that of Belgium, $2.71 per ton over that of Germany, $4.07 over that of England, and $4.87 per ton over that of the United States.

While these calculations may not be in all cases accurate and may even contain some serious errors, they do show how the high fuel prices prevailing in France have affected iron and steel costs and limited the competitive strength of the French iron and steel industry. Unless the fuel problem is solved iron and steel manufacture in

France seems destined to be carried on at high cost, or Lorraine ore to continue to serve the steel mills of Germany. The latter alternative is deemed by Frenchmen out of question.[1]

The significance of the situation is fully appreciated in France. Reasons other than large ore deposits influenced Frenchmen to look forward to the restoration of Alsace-Lorraine. The iron-ore deposits, however, constitute by far the most valuable natural resource of these provinces, whose economic development depends in large part upon their exploitation and utilization. To promote this development without making French ore subsidiary to German iron and steel it has been suggested and strongly advocated that the Saar basin to the northeast be annexed to Lorraine.[2] This district, as has already been pointed out, is one of the prominent coal-producing regions of Germany. It has also been the seat of a flourishing iron and steel business, which like the more important manufacturing district of Westphalia has depended upon Lorraine ore.

The Saar district, however, while containing large coal deposits, only meets the situation partially. Its resources are not commensurate with the enormous demands which would be made upon it in the event of such a growth in the French iron and steel industry as is anticipated by certain writers. The coke production of the district is neither large nor high in quality. Thus out of a total output of 17,846,000 tons of coal in the basin of the Saar in 1913, only 3,292,000 tons were converted into coke,[3] which was consumed for the most part locally. Furthermore finely washed coking coal in this district yields only 65 per cent coke, whereas the superior coking coal of Westphalia and of England yields from 72 to 76 per cent coke.

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[1] The Iron and Coal Trades Review (London), December 6, 1918, p. 633.

[2] Bulletin of the American Institute of Mining Engineers, September, 1918; Iron and Coal Trades Review, January 10, 1919; Washington Post, January 13, 1919.

[3] The Iron and Coal Trades Review (London), January 10, 1919, p. 47.

It is reported that during the war means have been discovered for coking at a low price coal hitherto declared to be unsuitable for the purpose. While it is true that only laboratory tests have been applied, it is considered beyond doubt that so far as coke manufacture is concerned an industrial solution is in prospect. With such a solution it is held that the incorporation of Alsace-Lorraine and the Saar, after deducting the needs for domestic consumption, gas works and railroads, would result in a production of 12,000,000 tons of coal capable of being transformed into coke [1] and rendered available for the blast furnaces of France. Twelve million tons of coal would, under the new processes referred to, make from 8 to 9 million tons of coke — or between two or three times the domestic output of France in 1913, but only about one-fourth the production of Prussia during the same year. Assuming all considerations of language and present ethnic relationship on the part of the people of the Saar district to be set aside and the region incorporated with Lorraine, the prospective development of a great French iron and steel industry commensurate with her enormous ore supplies would still confront a fuel problem.[2]

The effect upon Germany of the loss of Lorraine will depend very largely upon the policy adopted by France with regard to the exportation of ore to her neighbor. It has already been noted that the German iron and steel industry has in the main been based upon the Lorraine ore field. This relationship extended not only to German Lorraine, but to the part of the field embraced within Luxemburg and to a less extent to the district within France. If the supply of ore is cut off from all that part of the Lorraine region now to be embraced within the boundaries of France, Germany will be shut out from sources which supplied over 50 per cent of her iron ore in 1913, including her large importation.

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[1] The Iron and Coal Trades Review, January 10, 1919, p. 47; Bulletin of American Institute of Mining Engineers, September, 1918.

[2] It has been reported that at the Peace Conference in Paris, those of the French who strongly advocated the annexation of the Saar basin to provide coal have receded from their position. Iron Age, January 30, 1919, pp. 315 and 316. The temporary control of this region by the French, however, seems to have been agreed to as part of the indemnity to be paid by Germany to France. Washington Post, April 2, 1919.

The situation for Germany in the event of the elimination of these sources of ore supplies is even worse than this. The mining interests of Luxemburg are closely associated with those of Alsace-Lorraine, and if the iron ores of the latter become a basis for a great French iron and steel industry, Luxemburg is likely to become associated with France, and to separate from the German Customs Union. A statement recently made by the general director of the Burbach-Eich-Dudelingen Company and the reservations he made in connection with the provisional prolongation of the Steel Syndicate lead to the conclusion that this possibility exists.[1] In 1913 Luxemburg produced 7,332,000 tons of ore, or over one-half million tons more than the German Empire outside of Lorraine.

It has been contended that Germany may still look abroad for the greater part of her ore. Large quantities of Swedish and Spanish ores were being imported prior to the outbreak of hostilities. This importation, however, would have to be increased manyfold to compensate her for the loss of Lorraine, and preserve her iron and steel industry on the pre-war level.[2] If iron ore no longer moves from Lorraine to the Rhenish-Westphalia and Saar districts (assuming that the latter remains a part of German territory) the backbone of the present German iron and steel industry will be broken.

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[1] The Iron and Coal Trades Review (London), December 6, 1918, p. 633, and November 29, 1918, p. 611.

[2] The difficulties which the Germans have experienced in securing iron ore in other countries is treated in a report from Consul General Halstead at Stockholm to the Bureau of Foreign and Domestic Commerce. See also Iron Age, January 30, 1919, p. 329.

A confidential German document, which has recently been published by the Comite des Forges de France and quoted in the *Iron Age*,[1] gives some idea of the attitude of steel producers in Germany toward the control of the sources of iron ore, both from an industrial and a military standpoint, and also shows the cause of the apprehension naturally felt in France with regard to furnishing the raw material for German iron and steel manufacture. This document, which was probably written at a time when Germany was confident of a victory, emphasizes the determination of that country to take possession of the French mines, considered imperatively necessary in order to insure the future prosperity of the iron and steel industry of Germany. After pointing out that for many years Germany has been obliged to depend on other countries for a part of its supply of ore it remarks that " our mining base enlarged by the addition of Briey and Longwy would insure for a century the future of our iron industry, and would hence insure also our retention of the place which, with the help of the iron ore of Lorraine, we have conquered during the last ten years among the iron-making countries of the world, at the cost of hard struggles with Great Britain."

It also states that the greater the iron and steel-making resources of a country the more it is dreaded as an adversary. It then goes on to say that the displacement of the Lorraine frontier is absolutely indispensable for the safety of the German Empire in the case of a future war, and adds further:

" All of Lorraine in the hands of Germany would constitute not only a war indemnity and a support for the

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[1] Iron Age, February 20, 1919, p. 506.

German fatherland, but also a guarantee of a lasting peace and a gauge for the security of the empire. Our victory gives us the occasion and the right to add to the most vulnerable point of attack on the German Empire a sharp rock against which every enemy assault will be broken.

" If this opportunity be neglected, the German people will in a future war be doomed to ruin."

The failure of Germany to secure the displacement of the Lorraine frontier in the manner contemplated is looked upon in that country as a calamity to its steel industry,[1] involving as it does not only a loss of political control over an area deemed necessary to national safety but a possible elimination of the most important source of its supply of raw material. The German industry still entertains some hope that France's need for fuel will ultimately force her to exchange ore for coke; but any tutelage in regard to coke is what France sincerely desires to avoid.

The attitude of France with reference to the exportation of iron ore is of course intelligible in the light of the experiences through which she has passed and in the face of exposures like the document above cited. It is not to be attributed to commercial particularism with which France has sometimes been charged. The ambition to make her enormous ore resources serve a home industry rather than the industry which was lately used by a powerful neighbor to despoil her of those resources is laudable from both a patriotic and ethical standpoint. The fact remains, however, that metallurgical processes being what they are and the resources of Continental Europe in ore and coal distributed in the manner above described[1] the economic feasibility of any taboo on an interchange of ore and coke between France and Germany, is, to say the least, very questionable. The iron ore problem of Lorraine, viewed in the light of the present technical processes of iron and steel manufacture, is a good example of how political aspirations and ethnological considerations may come into conflict with an economic situation.

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[1] The Iron and Coal Trades Review (London), December 6, 1918, p. 633; Iron Age January 30, 1919, p. 329.

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[1] France is well supplied with water-power which would be available if electric steel could be made as cheap as Bessemer and open-hearth. The progress in the manufacture of electric steel, while great, does not at present promise much in the way of supplanting the product dependent directly upon coal and coke.